Developments in Non-Lethal Payloads for 12-Gauge Shotguns and 40mm Grenade Launchers

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Background

The increasing trend towards US soldiers being engaged in peacekeeping operations has inevitably focused attention on the need to provide the infantryman with a wider range of non-lethal munitions to supplement existing lethal ordnance. Although non-lethal (perhaps better described as less lethal) ordnance is still in its infancy, non-lethal ordnance items have now been fielded, or are in development, in all the major gun calibers available to the infantryman; including 5.56mm, 7.62mm, 12-gauge and 40mm grenade launchers. In this context, 12-gauge shotguns and 40mm high and low velocity grenade launchers (MK19 and M203/M79 respectively) are probably the most versatile weapons for infantrymen to launch non-lethal ordnance from a standoff position. One reason for this is the wide range of distances that can be covered by 12-gauge and 40mm ordnance, another being the relatively large volume, particularly in 40mm projectiles, for incorporating non-lethal payloads.

This paper firstly describes work carried out to develop 37mm and 40mm pepper spray cartridges for law enforcement and military applications respectively. A description is also given of collaborative efforts with two European companies – Nico Pyrotechnik of Germany and Primetake of England – to extend the range of non-lethal payloads suitable for launching from 40mm and 12-gauge delivery platforms.

Pepper Spray Projectile

Delta Defense has developed an improved non-lethal projectile for use in hostage, barricade and tactical assault situations. This work was carried out initially in 37mm caliber and was funded in part by the National Institute of Justice's non-lethal program.

Hostage/barricade incidents pose one of the most difficult situations ever encountered in law enforcement. They call for a measured response to subdue criminals without causing injury to

either the criminal, the hostages or innocent bystanders. Under these circumstances, it is essential that the responding officers should have access to a greater range of improved weaponry to allow them to respond appropriately in the event it proves impossible to end a hostage/barricade incident by negotiation or other peaceful means.

The chemical tear gas agents - CN, CR and CS - have all been used extensively by the military mainly in riot control situations. Pepper sprays (based on oleoresin capsicum) have now largely replaced CS and CN for use by law enforcement in apprehending individuals in one-on-one situations. Unfortunately however, despite all their advantages over the tear gases, pepper sprays have not yet been widely used from a standoff position for crowd control or to counter hostage/barricade situations.

The statement of work for the pepper spray projectile identified the following characteristics:

- Capable of being fired from an existing 37mm law enforcement gas gun.
- Able to deliver the projectile to 100 feet (essential) or 150 feet (desirable) with sufficient accuracy to repeatedly hit a 3 feet x 2 feet target, using only a simple sighting system, by an operator requiring only a minimum amount of training.
- Able to deliver the projectile through a plate glass window or household window glass with a screen or blind, yet be non-lethal at the minimum operational range (50 feet) in the absence of any obstacle.
- Capable of delivering a fine atomized spray of liquid sufficient to fill a volume of at least 1,000 cubic feet within one second of penetrating the above glass targets, or on striking an internal wall or ceiling if entry to the room can be achieved through an open door or window.

Delta Defense is continuing this work under a follow-on grant from the National Institute of Justice with the following additional constraints:

I. The projectile shall be designed and chambered to fire in the 40mm M203 and M79 grenade launchers.

II. The pepper spray container and dispersal system should be adaptable for use in 37mm gas guns.

III. The final product should be ready for production after appropriate tooling development.

40mm Cartridges from Nico Pyrotechnik

Nico Pyrotechnik, based outside Hamburg in Germany, has been developing and fielding 40mm non-lethal ammunition for many years. Nico 40mm high and low velocity cartridges are in service use with German and other NATO and European armies, as well as with law enforcement agencies throughout the world, including the US. All Nico 40mm cartridges comply with the appropriate NATO

STANAGs. A NATO Panel on 40mm Ammunition Standardization, chaired by an ARDEC representative, monitors cartridge interoperability in the various NATO 40mm grenade launchers and ensures that all new HE and training cartridges are ballistically matched to the appropriate US high and low velocity HEDP cartridges (M430 and M433 respectively).

The company offers a wide range of non-lethal payloads in both high and low velocity cartridges, including:

- Visible (white light) illumination (with parachute)
- Infrared illumination (with parachute)
- CS pyrotechnically disseminated
- CS or OC (pepper) in dust form
- Screening smoke
- Signaling smoke (colored)
- Sound & Flash (distraction)
- Training with tracer
- Training with impact signature.

Other non-lethal payloads are currently in development such as providing the ability to mark a person with a visible or fluorescent dye for subsequent identification purposes.

Nico has developed a unique propulsion system for both low velocity (40mm x 46) and high velocity (40mm x 53) projectiles. This design provides greater accuracy (reduced dispersion on the target) and more predictable performance particularly at extreme temperatures. By anchoring the projectile to the high pressure chamber, projectiles are ejected only when predetermined pressures are achieved.

The Nico propulsion system is present on the Diehl GmbH Tracered High Explosive Fragmentation Grenade with Self-Destruct Fuze (40mm x 53 M-DN11 HE-PFF-T) that is about to undergo testing by ARDEC. It also forms part of the Nico Practice Impact Signature cartridge that is currently being considered by PM Small Arms at ARDEC as a cheaper alternative training cartridge than the M918.

The following 40mm sound & flash cartridges have been developed for non-lethal defense applications.

40mm x 46 Cartridge, Sound & Flash, Impact Initiated, for M203/M79 Grenade Launchers

This impact initiated cartridge is designed to function when the projectile passes through a door or window. This considerably enhances the surprise effect and widens the range over which distraction devices can be used beyond that possible with hand thrown stun grenades. The projectile fuze has a safe & arming mechanism that is functioned by projectile spin.

40mm x 46 Cartridge, Sound & Flash, 1.3 Second Delay, for M203/M79 Grenade Launchers

This fixed delay (1.3 seconds) grenade can be used as an aerial distraction device for example to disperse or control rioting crowds. For this application the round would need to be fired to the side of the crowd to avoid causing injury from falling plastic and aluminum debris from the projectile body.

The following 40mm CS cartridges have been developed for non-lethal defense applications.

40mm x 46 Cartridge, Micronized CS Dust, Impact Initiated or Pyrotechnically Generated with 1.3 Second Delay and 15 Second Burn Time, for M203/M79 Grenade Launchers

These cartridges provide the user with a riot control and suppression tear gas CS device fired from M203/M79 grenade launchers. The *impact initiated CS cartridge* is completely smokeless and contains no pyrotechnic components. Penetration of a window or other surface causes the projectile ogive to break liberating the CS dust without any risk of fire. The *pyrotechnically initiated CS cartridge* ignites after a delay of 1.3 seconds and burns for approximately 15 seconds. It generates more CS than the dust grenade but is better suited to crowd dispersal outdoors where the risk and consequence of causing fires are less severe.

In addition, an inert practice (training) cartridge has been designed for the impact initiated CS dust device. This can be filled with chalk or talc to simulate the CS dust and eliminates the need for decontamination of training facilities.

All the above CS cartridges are sufficiently compact to fit in the M203 grenade launcher.

40mm x 53 Cartridge, Micronized CS Dust, Impact Initiated, for MK19 Grenade Machine Gun

This cartridge provides the user with a riot control and suppression tear gas CS device fired from the MK19 grenade machine gun. The grenades are impact initiated (smokeless) releasing CS dust. Again an inert practice (training) cartridge has been designed containing either chalk or talc to simulate the CS dust.

Aerial Distraction and Impact Cartridges from Primetake

Aerial Distraction Cartridges

Primetake has developed a range of 12-gauge birdscaring cartridges comprising a bright flash and loud sound (up to 165dB) or high pitched screech. They are designed to be entirely free from FOD (Foreign Obj. t Damage). This is obviously critically important if they are to be used close to aircraft jet engines where the ingestion of a foreign object can easily destroy turbine blades with catastrophic results. This characteristic means that birdscaring cartridges are ideal for use as aerial distraction and confusion rounds for firing over the heads of crowds to disperse them. They can be fired from standard military unchoked shotguns of any barrel length. The black powder propulsion charges for this application have been replaced by double based smokeless propellants to comply with standard US military requirements to prevent barrel fouling and ensure moisture resistance.

Specifications for the Primetake range of aerial distraction cartridges are given in the table.

The Standard Range Cartridge produces a smoke trail during flight and a loud sound (165dB at 2 meters) with a bright flash at 30-40 meters.

The Long Range Cartridge produces a trail of incandescent particles during flight and a loud bang at 50-60 meters.

The Extended Range Cartridge produces a bright tracer during flight with a loud bang and bright flash at 80-90 meters.

The Screech Cartridge produces a high pitched 'screech' for the duration of its 80-100 meters flight but has **no** bang.

Finally, *the Blank Cartridge* has a 140dB bang but **no** projectile.

Primetake 12-Gauge Aerial Distraction (Birdscaring) Cartridges

PART No.	PT1000 Standard Range	PT1001 Screech Cartridge	PT1006 Long Range	PT1010 Extended Range	PT1002 Blank Cartridge
SPECIFICATION					
Top Card Colour	Black	Green	White	Buff	White
Weight	25g	25g	25g	28g	20g
Chamber Length	76mm	76mm	76mm	76mm	67mm
Nett Explosive Quantity	6g	4g	6g	7.5g	3g
Delay Time	1.3 sec	N/A	2.3 sec	3-4.0 sec	N/A
Sound Level	165dB at 2m	N/A	165dB at 2m	155dB at 2m	140dB approx
Range @ 45°	30-40m	80-100m	50-60m	80-90m	N/A
PACKAGING					
Type	UN Approved Cardboard Outer				Cardboard Outer
Dimensions (mm)	340 x 220 x 130				320 x 220 x 115
Quantity per Pack	25 per Inner Box; 200 per Outer Box				250 per Outer Box
Weights	Gross (GW) 4.8Kg; Nett (NW) 4.5Kg;				GW 4.0Kg
	Nett Explosive Quantity (NEQ) 1.2Kgs (approx)				NW 3.8Kg
Shelf Life	2 years minimum in cool dry conditions				NEQ 0.75kg
CLASSIFICATION					
UN Serial Number	0431				0012
Correct Technical Name	Articles Pyrotechnic				Cart. Small Arms
Hazard Compatability	1.4G				1.4S
Transport	Commercial				Commercial
HSE Approval Cert No.	72-Z-00361				01280

Impact Cartridges

Primetake, in conjunction with Delta Defense, is developing a range of impact projectiles (40mm and 12-gauge) based on spherical rubber bags containing powdered metals mixed with lower density powders. The metal powder can easily be adjusted to give a range of weights and velocities to ensure accuracy at all expected engagement ranges. This approach has the advantage that deformation of rubber bags containing metal powders is highly dependent on impact velocity being much greater than that associated with solid rubber sting balls or beanbags containing lead shot. These devices are therefore likely to be less lethal than solid rubber balls or beanbags at short ranges because the impact energy is spread out over a much greater surface area of the body.